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First Notes – Pass 5

Primary Sources

1. ***Measuring Cardiac and Electrodermal Responses of Emotional States and their Persistence***
   This study was the first to examine the persistence of an EIM paradigm. According to our valence–arousal self-report, the valenced adjectives changed quickly to neutral ones after the second minute of the recovery phase, which is congruent with Gomez et al. (2009) and Kuijsters et al. (2016), both using videos. However, over time, SCL remained increased at least 4 min more for positive and negative EIM. One possible explanation for this longer-lasting arousal effect could be that, contrary to the physiological measures, the self-report rates are discrete measurements that cannot continually capture all the variations of the emotions felt (Mauss and Robinson, 2009) or participant's attention to the stimulus decreases. (**p.11**)

2. ***Embodied Cognition is not what you think it is***
   Does the organism, in fact, assemble, and use these resources? It is always an empirical question whether the dynamical system hypothesized in step 3 is, in fact, an accurate description of the system the organism has assembled to solve the task. The basic experimental tool for establishing the identity of a dynamical system is the perturbation experiment; systems respond to perturbations of resources in a manner that is specific to the role that resource plays in the system, and this allows you to map the composition and organization of the system at hand (e.g., Kay et al., 1987, 1991; Wilson and Bingham, 2008)(**p.3**).

3. ***Event-related skin conductance responses to musical emotions in humans***
   The major finding of the present study is that musical emotions induce SCRs varying according to arousal. The activation of the sympathetic nervous system by musical excerpts is itself under control of many subcortical structures such as the amygdala, the hypothalamus, and cortical structures, especially the orbito-frontal cortex and the temporal lobes [2,4]. Thus, SCR measurement may offer a window to the brain structures involved in emotional responses to music. Indeed, it possible that SCRs sensitivity to arousal in musical emotions is subject to top-down regulations. In further studies, the recording of SCRs, in

addition to the use of neuroimaging techniques, would allow the assessment and the localization of neural networks associated with event related autonomic responses to music arousal. (**p. 148**)

4. ***Role of tempo entrainment in psychophysiological differentiation of happy and sad music?***
   As expected from previous studies on tempo variations (Dalla Bella et al., 2001; Gabrielsson and Lindstrom, 2001; Peretz et al., 1998), happy and sad music were clearly identified with emotion recognition rates superior to 89%. However, the happy/sad distinction ability decreased when the pitch variations were removed, and more importantly, the stimuli became less pleasant. However, the emotion originally intended for the sad Tempo-only stimuli remained well recognized (superior to 90%). This latter finding parallels previous results (Schellenberg et al., 2000), and supports the hypothesis that equating tone durations in sad excerpts give them a special "funeral" quality making them sound very sad. Moreover, since the sad Rhythm, and sad Melody stimuli were found to be more pleasant than the sad Tempo stimuli, it may also explain why sad Tempo stimuli were more easily associated to the negative (sadness) than the positive (happiness) emotion (**p. 23**)

5. ***Emotion elicitation during music listening: Subjective self-reports, facial expression, and autonomic reactivity.***
   Current findings revealed a strong positive correlation between subjective evaluations of the shortened and original excerpts, both when analyzing the ratings for the three affective dimensions and specific emotions, suggesting that the selected film music excerpts conveyed similar emotions independently of their duration. Additionally, our findings demonstrate that shortening the film music excerpts did not alter the emotional perception contained therein. This result goes in line with a previous study that certainly reported consistency of the emotional responses between long (30-s) and short (1-s) classical music excerpts (Bigand et al., 2005). Accordingly, it becomes necessary to open a methodological debate about how much time is needed to elicit steady and consistent emotions in laboratory controlled conditions, especially when using dynamic and complex stimuli such as music excerpts. (**discussion**)

6. ***The Role of Peripheral Feedback in Emotional Experience With Music***
   When we experience emotional feeling states we also experience body sensations associated with those states. But, as this research shows, this phenomenon can also work in the opposite direction: body sensations from one source can be misattributed/transferred to another. In this case, the body sensations of arousal due to exercise are attributed or transferred to the

music, and those sensations can intensify the emotion thought to be expressed by the music and/or the emotion felt in relation to the music. (**p. 113**).

7. ***Cardiovascular and respiratory responses during musical mood induction***
   The subjects' median emotional intensity ratings indicate distinct emotional experiences: the median rating was 6 for the fear and happiness inductions and 4 for the sadness induction on a scale of 0 (''none'') to 9 (''very much''). No differences were found on any of the traditional cardiovascular measures examined, but evidence was found that the heart rate decelerated during the sadness induction and accelerated during the fear inductions. Differences in total breath length and total expiration length were found in the expected direction (slower respiration during the sadness than the fear or happiness inductions) on the time-domain measures but not when changes during the clips were examined. (**p. 65**).

Secondary Sources

1. ***Music and Embodied Cognition: Listening, Moving, Feeling, and Thinking***
   Perceptions of external stimuli are nonmimetic representations, including the auditory perception of musical sounds. However, when we give our attention to musical sounds, they are also represented in the form of MMI and often in the form of MMA…Conceptualizations can be understood in part as enduring representations based on ephemeral mimetic and nonmimetic representations. For example, the musical concept of a step is grounded in nonmimetic perceptions of sounds and mimetic representations of sounds as imitable actions…Recognition of external stimuli is based in part on information gained via the external senses—the appearance, sound, feel (texture, temperature, weight, etc.), smell, and/or taste of external stimuli. But recognition is also based on other responses and representations in the perceiver, including mimetic representations…[and] Inhibition in the present context refers to neurological inhibition of action. (**p.40**).

2. ***Cross-Cultural Comparisons of Affect and Electrodermal Measures While Listening to Music***
   The limitations of these results highlight the importance of databases like EiM, as they serve as a starting point for the finer-grained studies required to thoroughly explore the relationships between affect and physiology. They provide the means for exploratory analyses that are not only strong enough in power to uncover legitimate links between affect and physiology, but also the data necessary to outline the design of the more focused studies required to reveal the details of these relationships. (**p.7**).

3. ***Origin of Music and Embodied Cognition***

According to a theory of drives and emotions developed by Grossberg and Levine (1987), instinctual drives are neural mechanisms similar to internal sensors in the mind-body. They measure vital bodily parameters and indicate to the organism their deviations from safe ranges. Emotional neural signals connect these instinctual indications to decision-making brain-mind regions (Grossberg and Levine, 1987; Grossberg, 1988). The emotions felt are associated with these neural signals. For example, a bodily sensor-like mechanism measures sugar level in the blood and indicates when it is below a safe range. This generates emotional neural signals, which are felt as hunger and drive decision-making mechanisms to look for food. Instincts and emotions are the mechanisms of embodiment. (**p.1**)

4. ***Musical Interaction reveals music as embodied language***
   Thirdly, timing is often not a matter of counting but rather a matter of moving, using outsourcing strategies by which limbs are moved, or choreographies are maintained in loops that don't require cognitive attention. Su and Pöppel (2012) showed that non-musicians rely more than musicians on their own movement in order to feel the pulse of a rhythmic sequence, missing it when such movements are not allowed. However, musicians can also rely on their internal clock to understand the sequence even without moving, thus demonstrating the importance of body movement, in particular where expertise is absent. In addition, it is worthwhile to remind that mirror neurons have been shown to depend also on such a sensorimotor expertise. For example, inferior-frontal and parietal areas typically involved in mirror activation, have been found to be more active (in a fMRI scan) in pianists, compared to naïve subjects, while observing piano-playing, compared to non-piano-playing, finger movements (Haslinger et al., 2005, see also Herholz and Zatorre, 2012). (**p.5**).

5. ***The Routledge Handbook of Embodied Cognition (pp. 81 – 89)***
   More direct evidence of embodied cognition is provided by studies showing how changes in the motor system correlate with changes in perception of structural and expressive features of music. Thereby, two categories of changes in the motor system are generally addressed: one category relates to impairments of the motor system (i.e. motor disorders), the other to the development of the sensorimotor system (i.e. sensorimotor learning) (**p.84**).